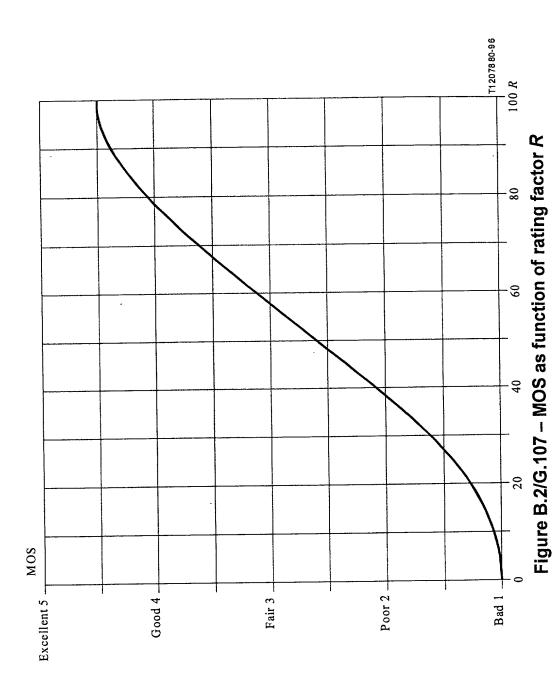
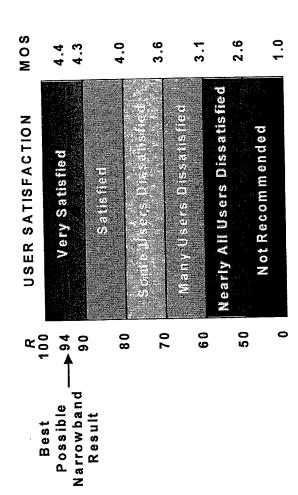
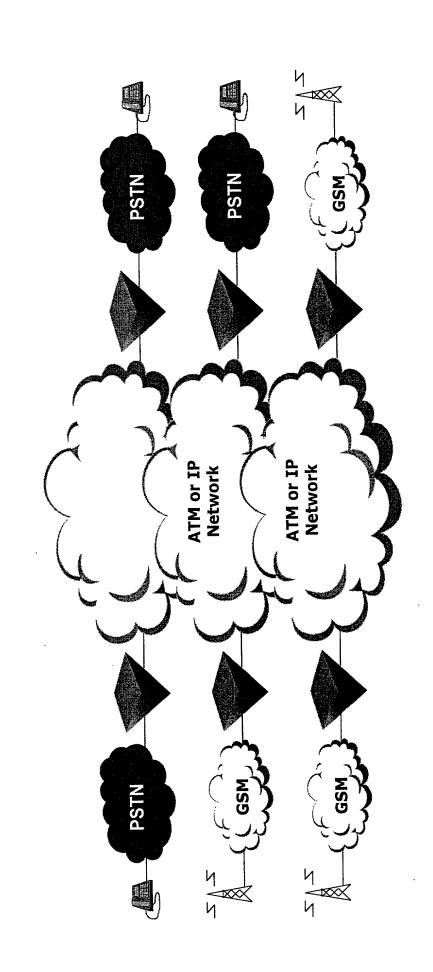


Figure B.1/G.107 - GOB (Good or Better) and POW (Poor or Worse) as functions of rating factor R



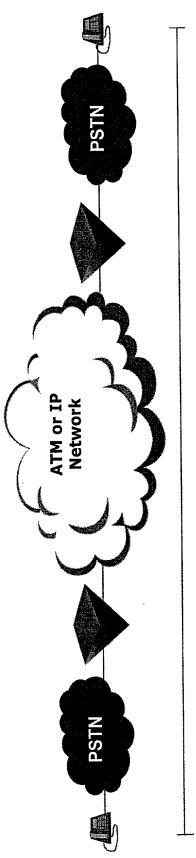


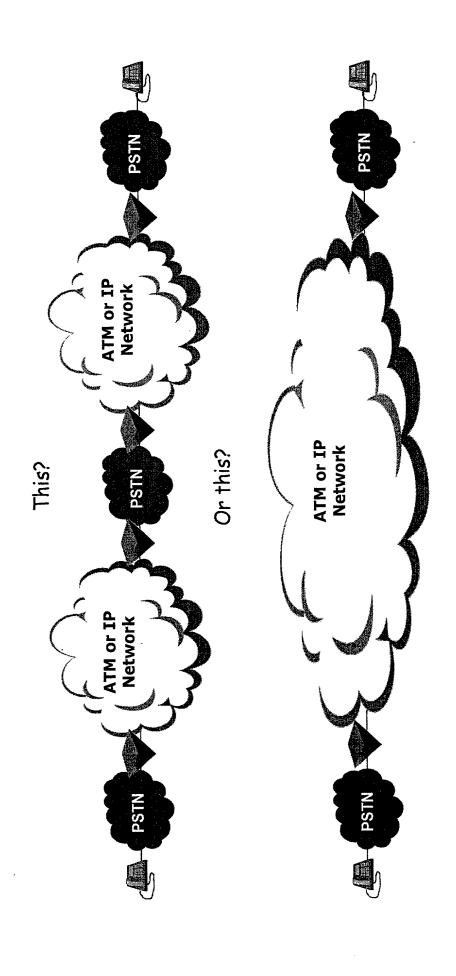


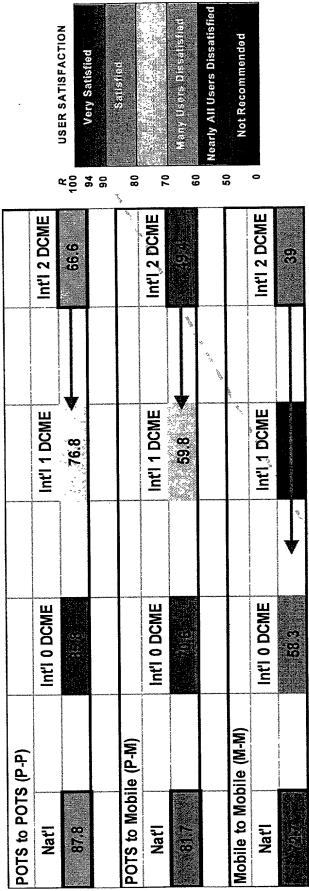
POTS to POTS (P-P)			erre automi electrolisticha politicata per automi electrolistica dell'especialistica d	
Nati	Int'I 0 DCME	Int'l 1 DCME	Int'l 2 DCME	
87.8		7.6;8	66.6	100 Vary Safefied
				90
POTS to Mobile (P-M)			- под дей в под в под дей в под	Notice that the second
National statement and the second statement of the sec	Int'I 0 DCME	Int'l 1 DCME	Int'l 2 DCME	02
the second control of		59.8		- Many Users Dissausifier
			,	Nearly All Users Dissatisfi
Mobile to Mobile (M-M)			ор лициона и чентунарадизивання частана выпаративня выпаративна вы	Not Recommended
Nat!	Int'I 0 DCME	Int'l 4 DCME	Int'l 2 DCME	0
	28.3	A Commence the second control of the commence	. 39	

Limit of acceptability - a hard threshold

Mobile is 6SM EFR. POTS is modelled for an analogue set. Nat'l = 8000km, Int'l = 27500km. What reference calls will be the most demanding quality measure?







Limit of acceptability - a hard threshold

Mobile is GSM EFR, POTS is modelled for an analogue set. Nat'l = 8000km, Int'l = 27500km.

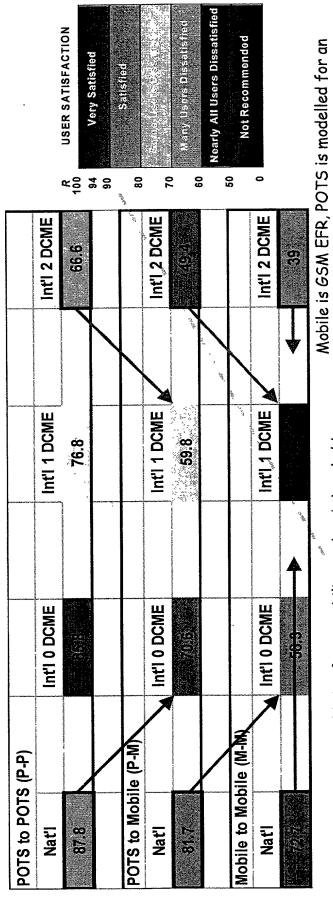
(\*5R = 0.2 MOS over most of the linear range considered in the statistical noise by many practitioners.)

POTS to POTS (P-P)			Contraction of the Contraction o	
parameter, uniquentemental en 1, 4, 4, 15, 1700 entrementementementementementementemente	Int'I 0 DCME	Int'l 1 DCME	Int'l 2 DCME	
87,8	manant unavaria a caractera	T6.8	9:99	ISN
				90 10 10 10 10 10 10 10 10 10 10 10 10 10
POTS to Mobile (P-M)			ence anno angliffith mai ano camana an camina proprincipo proprincipo de descripción de camana de la costa e consensario e de la costa de	80 Santanas
Nati	Int'I 0 DCME	Int'l 1 DCME	Int'l 2 DCME	
81,7.		59.8		Many Usors Dissaustion
	-		, , , , , , , , , , , , , , , , , , ,	Nearly All Users Dissatisfied
Mobile to Mobile (M-M)		and the state of t	Ментерия — достория ментерия на принципалний выполнять на принципалний выполнять пот принципалний выполнять пот	Not Recommended
NATE I	Int'I 0 DCME	Int'l 1 DCME	Int'i 2 DCME	0
A L C	28.3	And the control and the control of t	36	

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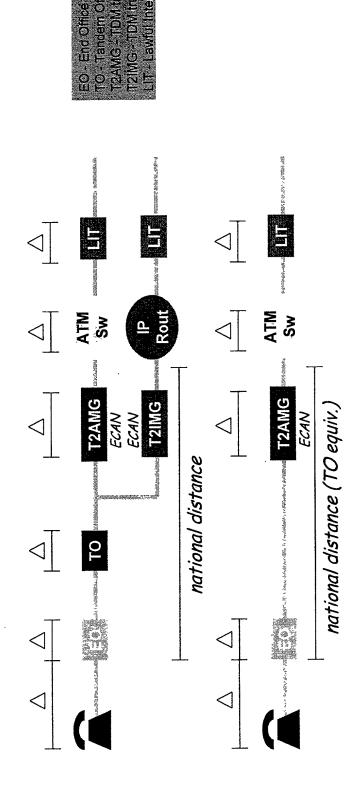
Limit of acceptability - a hard threshold

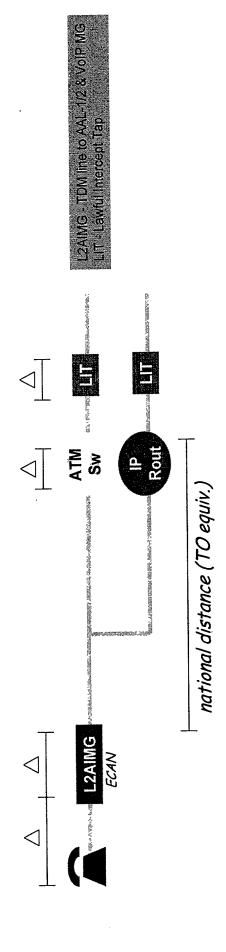
Mobile is GSM EFR, POTS is modelled for an analogue set. Nat'l = 8000km, Int'l = 27500km.

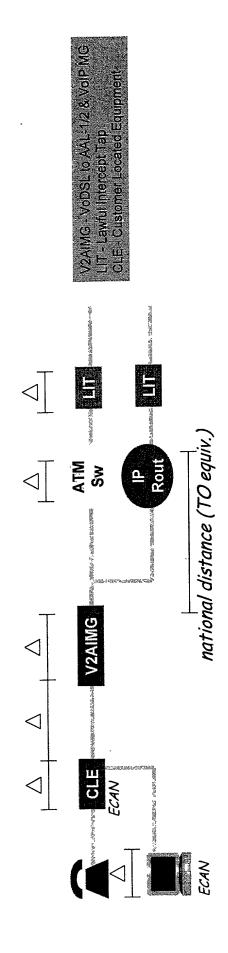


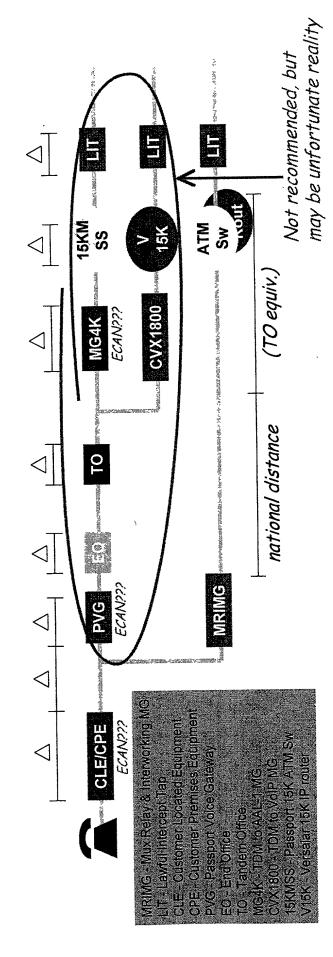
Limit of acceptability - a hard threshold

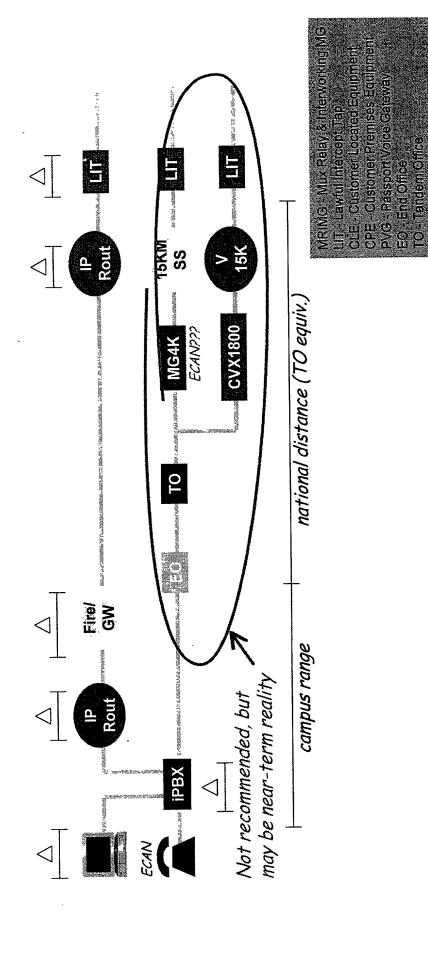
analogue set. Nat'l = 8000km, Int'l = 27500km.

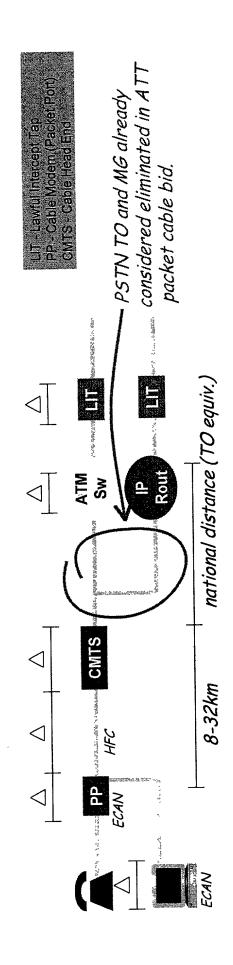


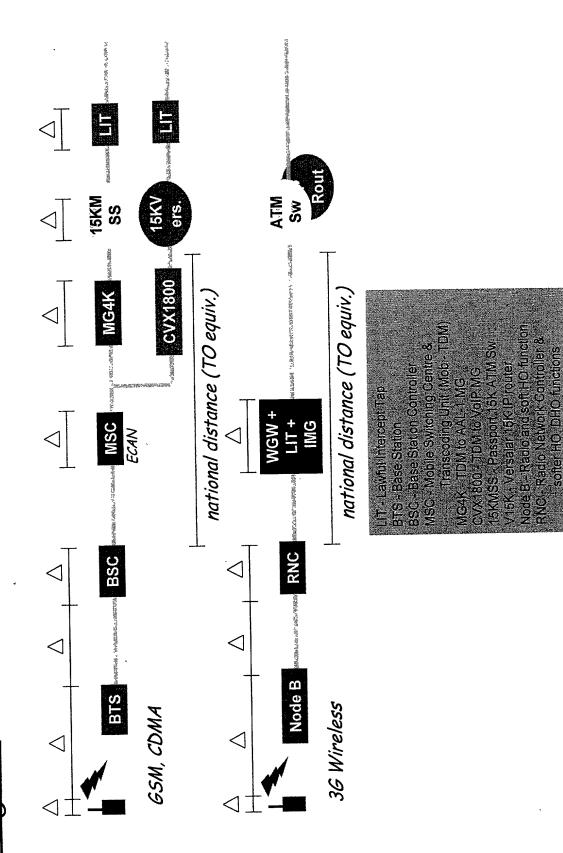








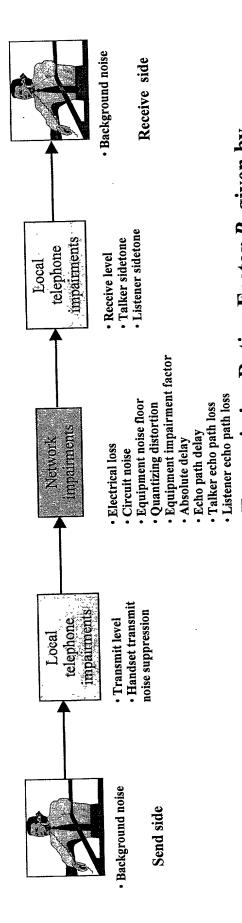




27,500km - 2\*(distance from subs to TO equiv.)

lumped national model lumped international model

lumped national model

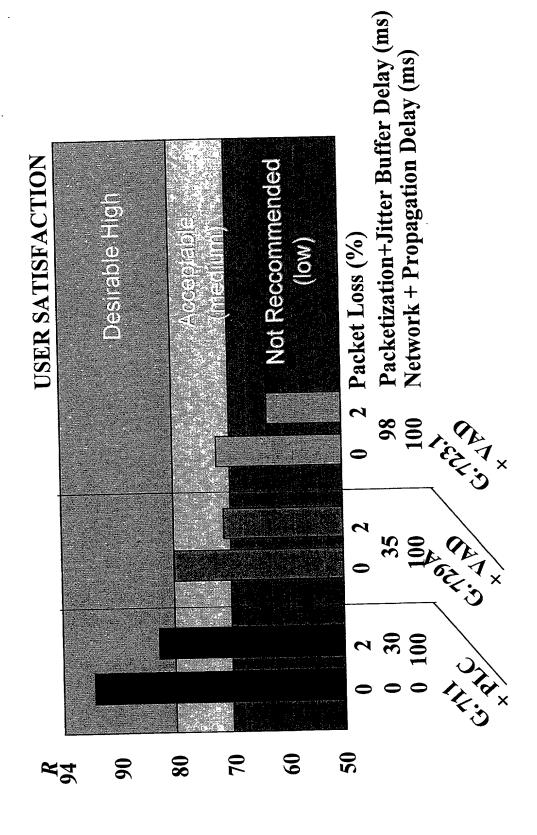


The E-model calculates a Transmission Rating Factor R, given by  $R = R_o - I_s - I_d - I_e + A$ 

E-Model Parameter Default Values

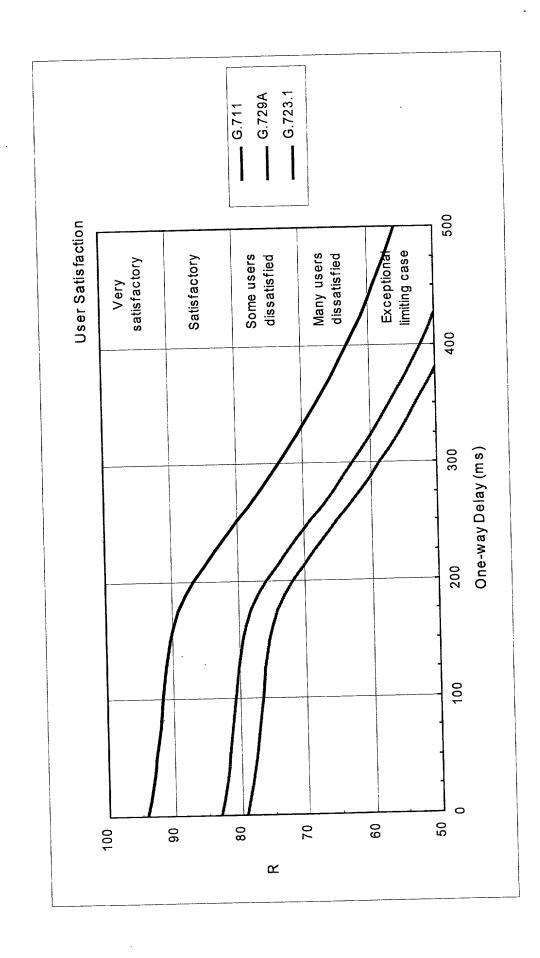
Parameter	Units	Value
SLR (Send Loudness Rating)	dB	8
RLR (Receive Loudness Rating)	dB	2
STMR (Sidetone Masking Rating)	dB	15
LSTR (Listener Sidetone Rating)	dB	18
OLR (Overall Loudness Rating)	dB	10
TELR (Talker Echo Loudness Rating)	dB	65
WEPL (Weighted Echo Path Loss)	dВ	110
T (Mean Intrinsic One-Way Delay)	msec	0
Ta (Absolute Delay)	msec	0
Tr (Round-Trip Delay)	msec	0
QDU (Quantization Distortion Units)	1	
le (Equipment Impairment Factor)	8	0
A (Expectation Factor)	ī	0
Ds (Handset Shape Factor - Send Side)	1	3
Dr (Handset Shape Factor - Receive	ı	33
Side)		
Ps (Room Noise at the Send side)	dB(A)	35
Pr (Room Noise at the Receive side)	dB(A)	35
Nc (Circuit Noise referred to 0 dBr-point)	dBm0p	-70
Nfor (Noise Floor at the Receive Side)	dBmp	-64

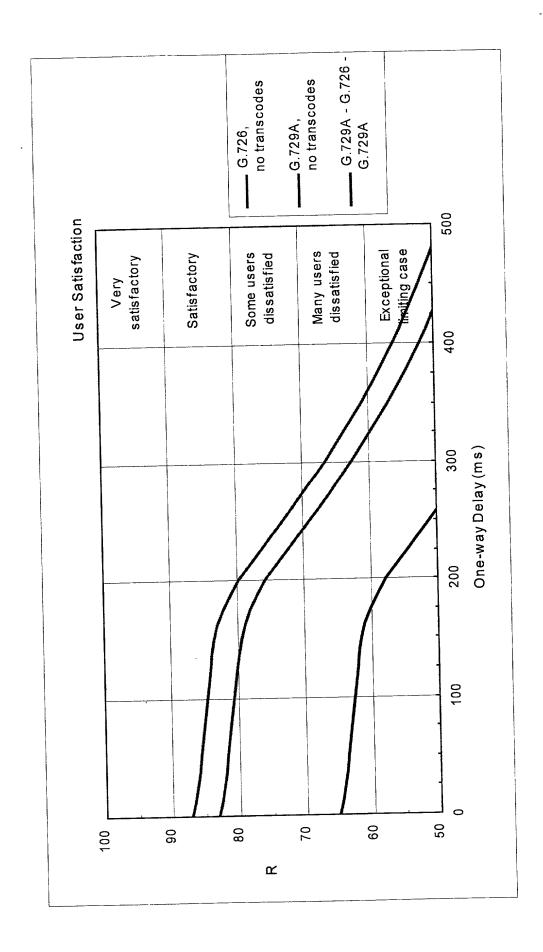
	<b>X</b>	USER SATISFACTION	Mos	%COB	%POW
Best possible narrowband —	100 <b>4</b> 94			7.00	yound *
result	60		4	0.76	0.5
(G.107 Detault)	80			89.5	Ameri 
	70		÷	73.6	5.9
	09		(max	56.1	-
	20	Not Recommended (Low)	9.	70.0	37.7
	0		*****	AND SERVICES	8.66

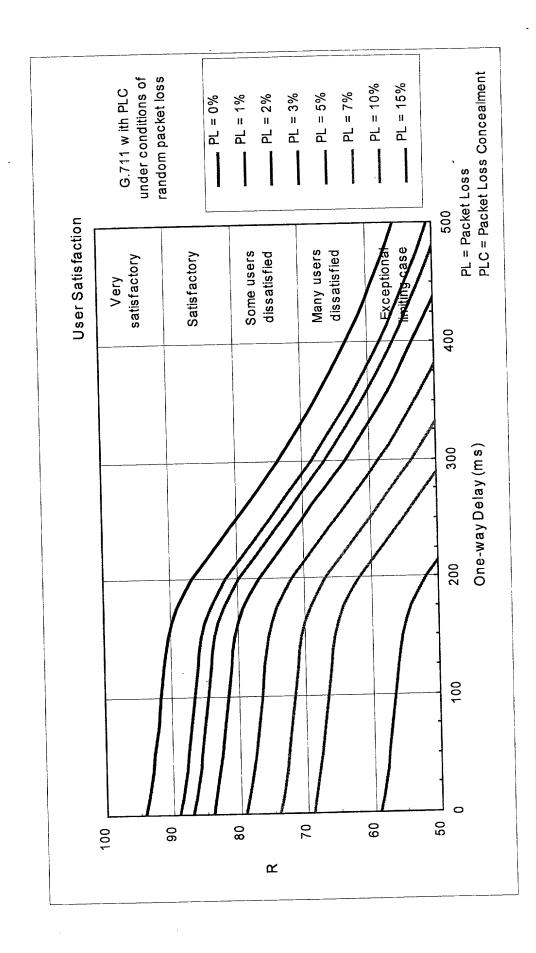


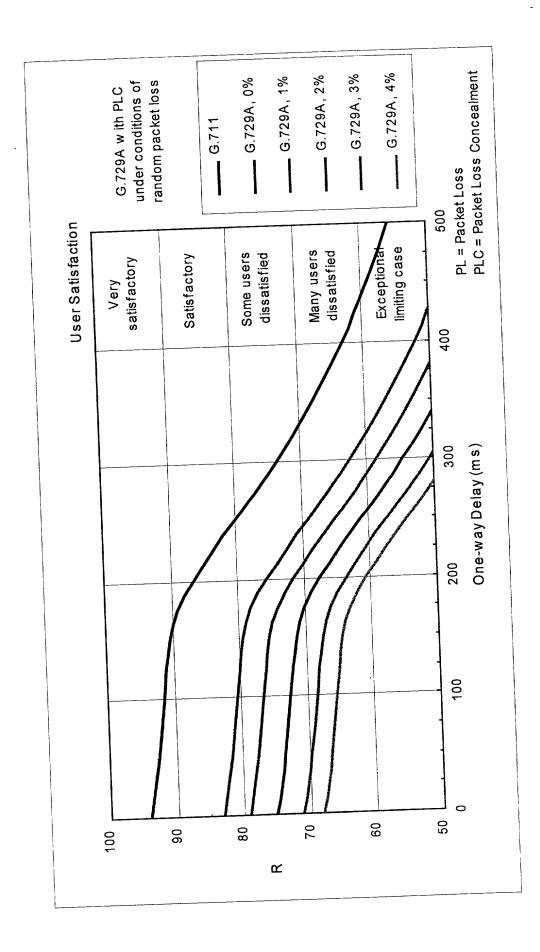
G-729A G-726 INves 1.31 32kb/s note [5]		40			11 7				32 NA	35 MA
G.729A   Notes 1, 3]	1.0	0.5				17	21	25	29	32
Model Calculations   G.729A   G.729A     G.729A   G.729A     Inotes 1.31	01				F	15	61	23	26	29*
1000 FO TOWN OF BOOK A COSTAL AND THE JULY 12/20	10	01				13	16	19	22	25
	.125	40			0	13	19	24	28	32
G.711    INotes 1, 2,	.125	30			0	101	9I	22	26	30
G:711  Notes.i,	.125	20			0	× ×	13	19	22	25
G.711 [Ref.10] [Notes 2, 3]	.125	0			-	) v		10	12.5*	15
	Frame Size	Packet	Tayload (ms)	Packet Loss	(%)		2		7	5

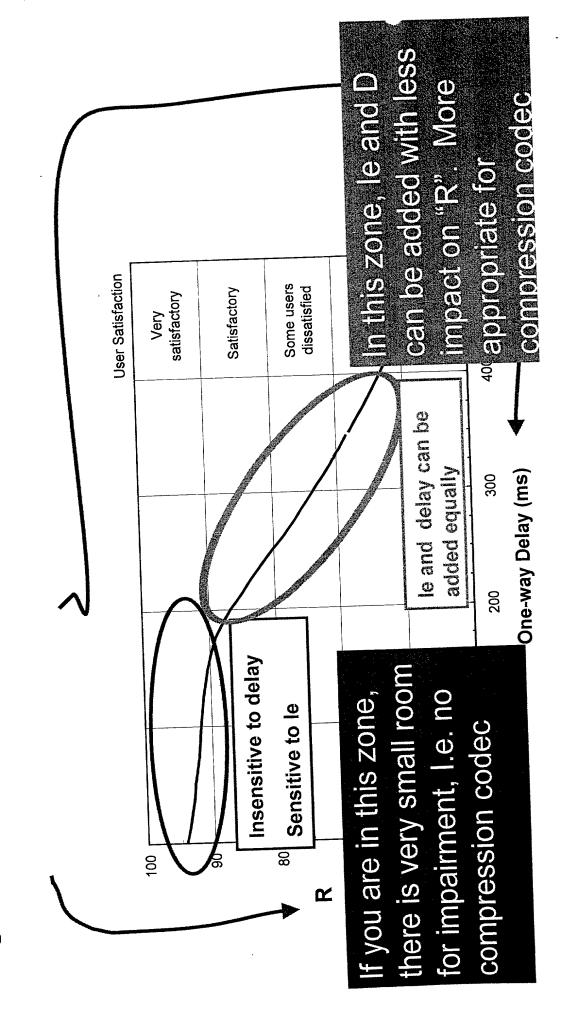
- 1) In the absence of any supporting documentation, these are arbitrary values
  2) All G.711 vocoders are assumed to have PLC (Packet Loss Concealment) algorithms
  3) Impairment factors apply for random packet loss conditions
  4) This is the current capability of the i2004 (in the absence of any download instructions to achieve smaller frame size)
  5) There is no PLC algorithm for G.726, therefore its deployment might be limited in lossy network
  6) Interpolated values

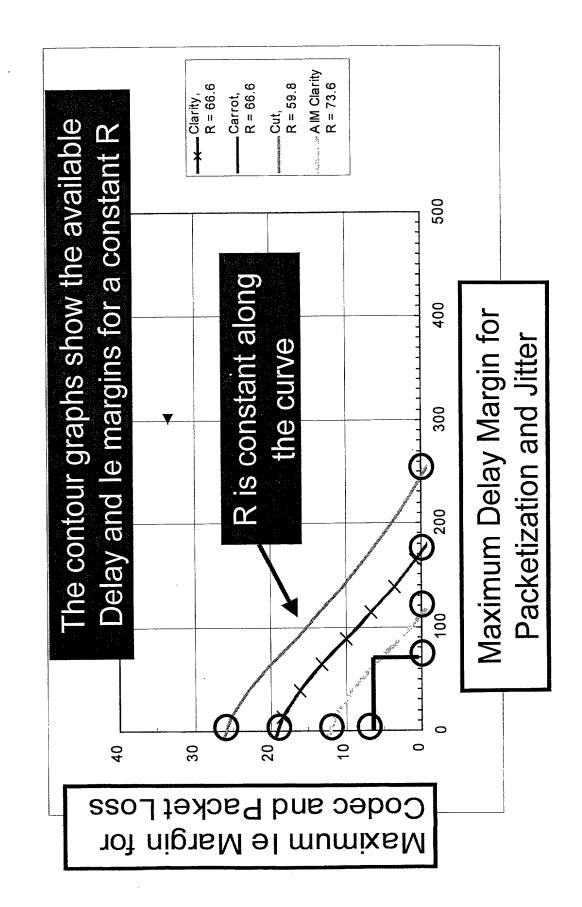












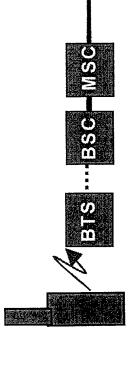
A- Side User Access
(Trunk or Wireless)

Transport Network

B- side User Access (Trunk or Wireless)

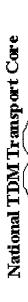
Title	Abbr	Abbreviation (Default)	E-Wodel Input
Flectric Circuit Noise (at 0 dBr)	Nc	(-70 dBmP)	
Room Noise	Po	(35 dBA)	35
Send Loudness Rating	SLR	(8 dB)	
Receive Loudness Rating	RLR	(2 dB)	3
D-factor	ρ	(3)	3
Noise Floor	Nfor	(-64 dBm0)	-64
Sidetone Masking Rating	STMR	(15)	15
Equipment Impairment Factor	le	(0)	0
Expectation (Advantage) Factor	A	(0)	0
Mean Intrinsic One-Way Delay (upper)	ηL	(0 ms)	0
Mean Intrinsic One-Way Delay (lower)	II	(0 ms)	0
Mean Intrinsic One-Way Delay	Tul	(0 ms)	0
Electrical Loss (upper)	Lu	(dB)	0
Electrical Loss (lower)	II	(db)	0
Electrical Loss (upper = lower)	Lul	(dB)	0
Quantizing Distortion Units (upper)	nnpb	(1) [Note 1]	0
Quantizing Distortion Units (lower)	Inpb	(I) [Note I]	0
Echo Return Loss	ERL	(dB)	17





BTS: Base Station BSC: Base Station Controller MSC: Mobile Switching Center

PSTN Wireless Access Delay, loss and Impairment Summary		
	Uplink	Downlink
Mobile Switching Center (MSC) (ms)		2
Base Station Controller (BSC) (ms)	2.5	40
Base Station (BTS) (ms)	15.8	40.8
Mobile Set (MS) (ms)	72.1	14.3
PSTN Wireless Access Delay (ms)	91.40	97.10
Impairment Factor (Ie)	5	2

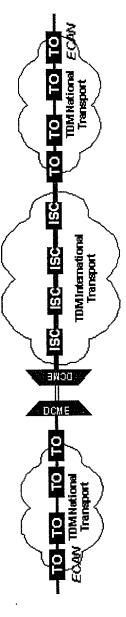




## International TDM Transport Core

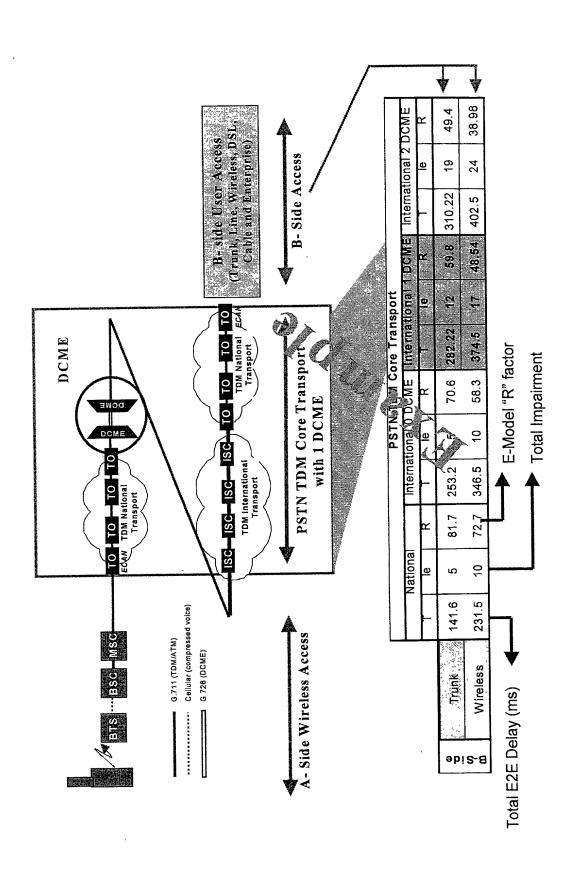


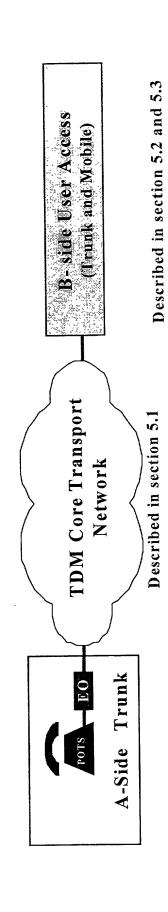
# International TDM Transport Core with DCME



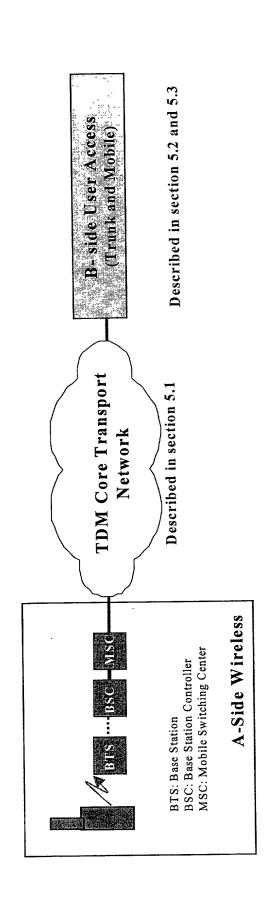
6.711 (TDM/ATM) 6.726 (DCME)

TDM Core Transport	National (8000km)	(conn	International ection Length 27	International (connection Length 27500 km)	km)
National Transmission Time	43	43	43	43	43
T2DCME (G.711/G.726 Conversion+DSI) (ms)	<b>THE</b>	0	26	52	78
DCME2T (G.726/G.711 Conversion) (ms)	VOLUMBAT HERATOR AND	0	2	4	9
International Transmission Time (ms	T CONTRACTOR CONTRACTO	72	72	72	72
National Transmission Time	ANALA ANALA ANALAMAN MANAMANDONOMONIO PROVINCIA PROVINCI	43	43	43	43
Total one-way delay (ms) Impairment Factor (Ie)	43	158 0	186	214	242





	_		
5	۲	9.99	49.4
्य	<u>o</u>	14	19
Internation	Т	218.22	59.8 310.22
OCME	R	76.8	59.8
International 1 DCME	<u>e</u>	7	12
Internal	-	190.22	282.22
OCME	œ	82.8	9.07
iional 01	e	0	5
Internal	_	161.22	253.22
	ጸ	87.8	81.7
National	le le	0	2
		46	139.24
Trunk Access	01	Trunk	Wireless



DCME	ፚ	49.4	38.98	
ional 2	<u>e</u>	19	24	
International	T	310.22	402.5	
I 1 DCME	ጸ	59.8	48.54	
tional 1	<u>e</u>	12	17	
International	L	282.22	374.5	
DCME	K.	70.6	58.3	
International 0 DCME	le	5	10	
Interna		253.2	346.5	
	R	81.7	72.7	
National	<u>e</u>	5		
		1416	231.5	
Wireless Access		Taink	Wireless	

A- Side User Access (Trunk, Line, Wireless, DSL, Cable and Enterprise)

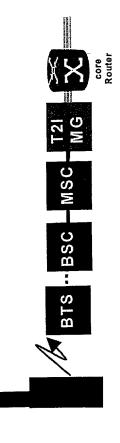
Core Transport
Network
(TDM,ATM or IP)

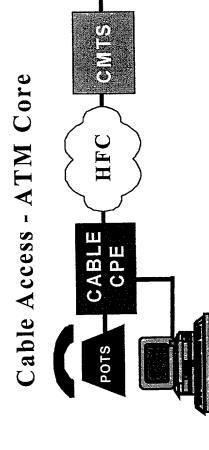
B- side User Access (Trunk Line, Wireless, DSL, Cable and Enterprise)

Trunk Access - ATM Core



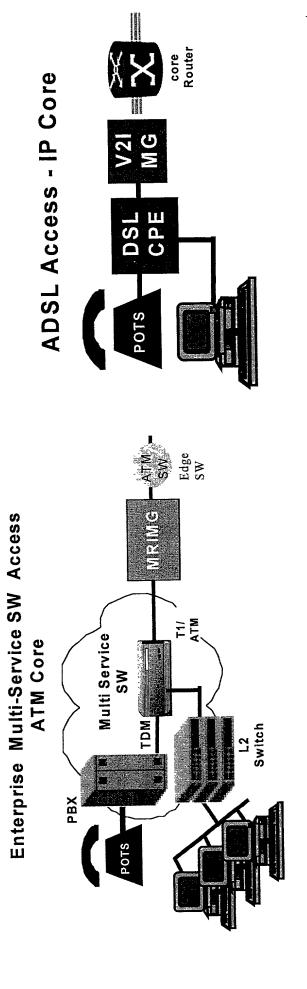
Wireless Access - IP Core







B- side User Access
(Trunk, Line, Wireless, DSL.
Cable and Enterprise)



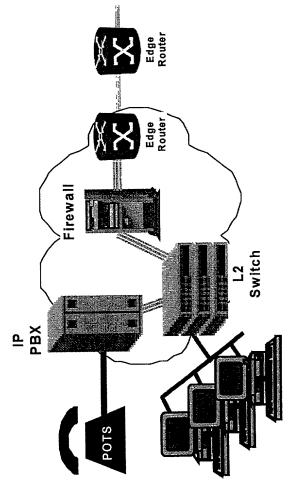
A- Side User Access (Trunk, Line, Wireless, DSL, Cable and Enterprise)

Core Transport
Network

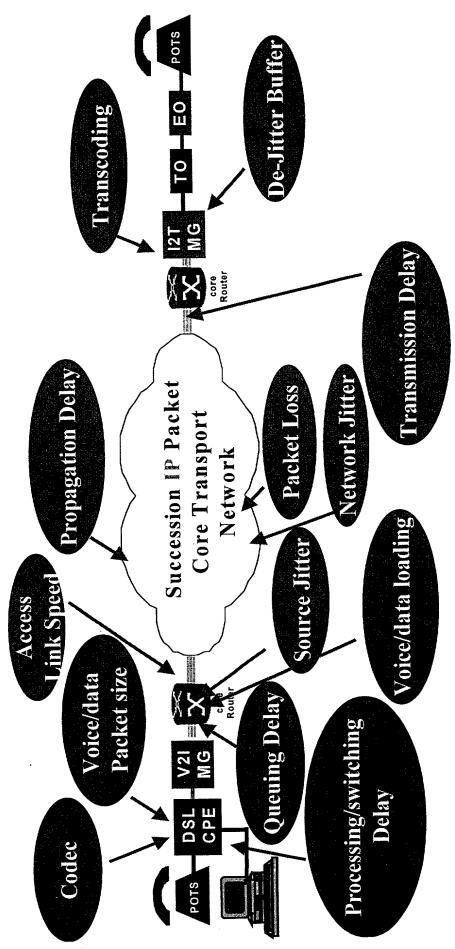
(TDM,ATM or IP)

B- side User Access
(Trunk, Line, Wireless, DSL,
Cable and Enterprise)

Enterprise IPPBX Access IP Core



Which impairments are being considered in the models?

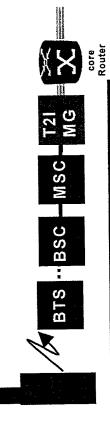


Trunk Access - ATM Core



Frunk Access to ATM Core (before 4 parameters budget assignment) Delay, loss and Impairment Summary	assignment)
Set delay (Side A) (ms) End Office Delay (Side A) (ms) Tandem Office Delay (Side A) (ms) T2AMG delay (Side A) (ms)	0 1.5 0.75 0.5
Trunk Access delay (ms) Impairment Factor (Ie)	2.75

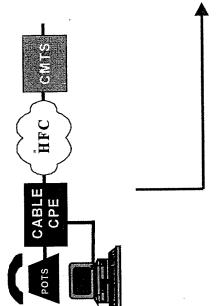
# Wireless Access - IP Core



Succession Wireless to ATM Core - Delay, loss ad Impairment Summary (before 4 parameters budget assignment)

	Uplink	Downlink
Mobile Switching Center (MSC) (ms)		2
Base Station Controller (BSC) (ms)	2.5	40
Base Station (BTS) (ms)	15.8	40.8
Mobile Set (MS) (ms)	72.1	14.3
T2AMG delay (Side A) (ms)	0.5	0.5
Wireless Access delay (ms)	91.40	97.10
Impairment Factor (Ie)	S	9

Cable Access - ATM Core



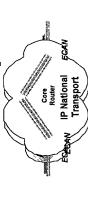
Cable CPE	Cable CPE Upstream	Cable CPE Downstrea m	Note
Link Speed	510 Kbps	3000 Kbps	note [1]
Voice packet size (byte)	160	160	note [2]
Voice packet overhead (RTP/UDP/IP)	48	48	
Data packet size (byte)	512	512	
Data packet overhead	48	48	
Voice packet link utilization (%)	10.0%	10.0%	
Data packet link utilization (%)	%0.06	%0.06	
Fixed Delay			
- Serialization delay for voice packet (ms)	3.26	0.55	note [3]
- DSP & CPU processing delay (ms)	12.00	14.00	note [4]
- Packetization Delay (ms)	0.00	N/A	note [5]
Variable Delay			
- Average Voice data contention (ms)	4.57	0.78	note [6]
- Maximum Voice data contention (ms)	9.15	1.55	note [6]
- De-Jitter buffer delay (ms)	N/A	0.00	note [5]
Other Impairments			
- Packet Loss (%)	0.00	0.00	note [5]
Minimum Delay (Fixed Delays) (ms)	15.26	14.55	
Average Delay (Fixed+Average Variable Delays) (ms)	19.84	15.33	
Maximum Delay (Fixed+ Max Variable Delays) (ms)	24.41	16.11	

A- Side User Access (Trunk, Line, Wireless, DSL, Cable and Enterprise)

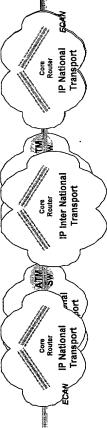
Core Transport
Network
(TDM,ATM or IP)

B- side User Access
(Trunk, Line, Wireless, DSL,
Cable and Enterprise)

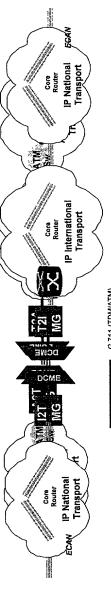
Nakidinial IMI France of Covee



Intutestitinial IVITznappot Core



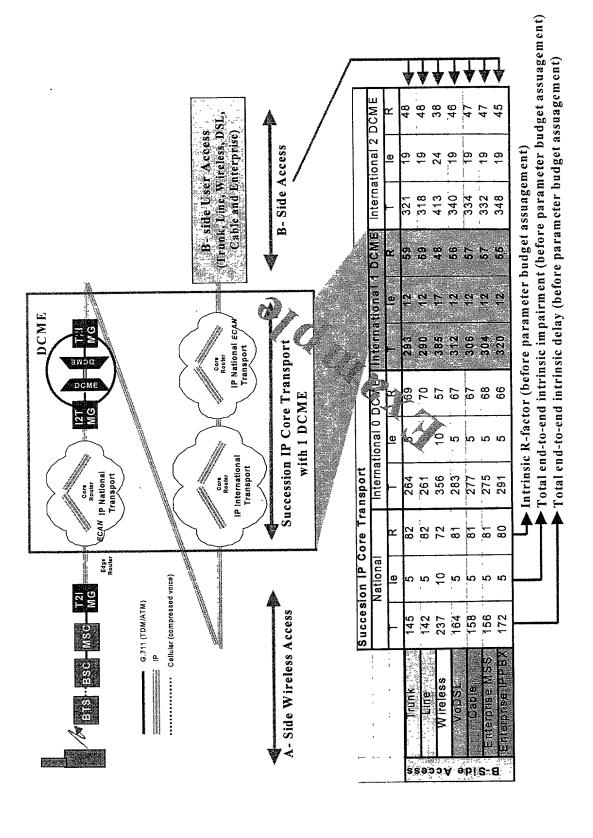
Inluteztidinlal TMI Panapput Cove ovidel BOUALE



G 711 (TDM/ATM)
G 726 (DCME)

Hotal National Transport Distance (km))	8000 km (IP)	8000 km (ATM)	8000 km (TDM)	Note
Terrestrial Distance (km)	0008	0008	8000	
Terrestrial propagation Delay @ 5us / km (ms)	40	40	40	From G.114
Submarine Distance (km)	1	•	ŧ	
Submarine propagation Delay @ 6us / km (ms)		1	1	From G.114
Number of hop	5	&	4	From i.356,
Equipment processing time (ms)	1ms x 5	0.03ms x 8	0.75ms x 4	TIA IS-810 G.114
Jitter (ms)	note [1]	1.5 note [3]	0	1.356 QoS class 1
Total Delay (ms)	45	41.74	43	Note [2]
Total Delay (ms)	45	41.74	43	١

Internation Core Fransport delay	27500 (IP)	27500 (ATM)	27500 (TDM)	Note
Terrestrial Distance (km)	16000	16000	16000	
Terrestrial Delay (a) 5 us / km (ms)	08	08	08	
Number of hop	15	19	12	From I.356, TIA
•		.,		IS-810
Equipment processing time per hop	1	0.03	0.75	G.114
Equipment processing time (ms)	15	0.57	6	G.115
Submarine Distance (km)	11500	11500	11500	
Submarine Delay @ 6us / km (ms)	69	69	69	
Jitter (ms)	note [1]	3	0	I.356 QoS class
				T
Total Delay (ms)	164	149.57	158	Note [2]



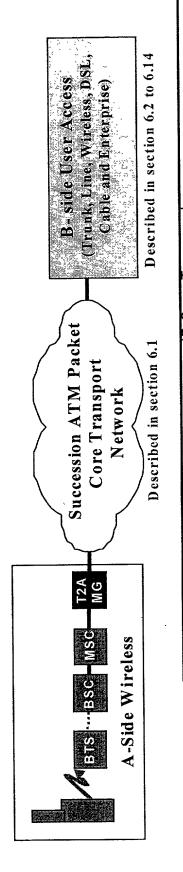
						,	AIM Core Iransport	re ran	sport			
		Nationa		International 0 DCME	tional 0	DCME	Interna	tional 1	International 1 DCME	Interna	nternational 2 DCME	DCME
	L	e	×	_	е	Y		Э	ĸ		e	¥
	47	6	88	161	b	98	190	-	7.7	218	14	29
	45	0	88	159	0	98	188	7	77	216	4	29
Wireless	139	, ro		253	5	7.1	282	12	09	310	19	49
2222 MAY	9 9	· c	87	180	0	85	209	7	75	237	4	64
	6	· c	. 80	175	0	85	204	7	75	232	14	65
	- 84	0	88	162	0	98	191	7	2.2	219	14	29
	64	0			0	82	207	<u> </u>		235		64

B-Side Access

comparison of an end-to-end Succession network with the closest benchmark representation of existing networks (PSTN Note: The four parameters: packetization delay, delay jitter, codec and packet loss have been set to zero. Those four parameters will be determined based upon the available margin. The margin is determined based on the benchmark only, mobile to PSTN, or mobile to mobile).

			ш		*	4	7	2	2	4	
			DCN	<b>۲</b>	64	64	47	62	62	64	62
41			nternational 2 DCME	e	14	14	19	4	14	7	14
Access feless, D'S ferprise) n 6.2 to 6.			Interna	_	237	235	329	257	251	238	255
B. side User Access (Trunk, Line, Whieless, DSL, Cable and Enterprise) Described in section 6.2 to 6.14		sport	DCME	Ж	75	75	22	72	73	75	73
B-si (Trunk Cabi		re Trans	ional 1	le le	-	7	12	7	7	7	A someon or the second of
		ATM Core Transport	International	_	209	207	301	229	223	210	227
Succession ATM Packet Core Transport Network Described in section 6.1			DCME	Y	85	85	99	83	83	85	83
ccession ATM Pack Core Transport Network Described in section 6.1			International 0 DCME	9	0	0	2	0	0	0	0
Core N N Describe			Interna		180	178	272	200	194	181	198
$\bar{\mathbf{s}}$				X	87	88	8	87	87	87	87
N.G.			Nationa	e	0	0	5	0	0	0	0
D S C D S C	VoDSI			L	99	64	158	86	80	29	84
POTS	A-Side VoDSL				P. O. S. Prunk		Wireless	SCION		Enterprise MSS	Enterprise IPPEX
						SS	ခော	эΑ	әр	!S-	8

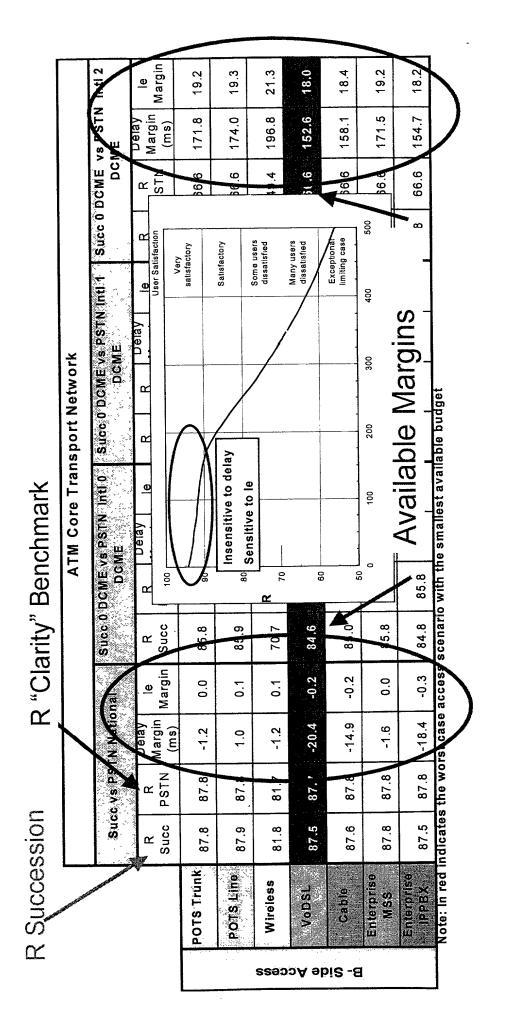
comparison of an end-to-end Succession network with the closest benchmark representation of existing networks (PSTN Note: The four parameters: packetization delay, delay jitter, codec and packet loss have been set to zero. Those four parameters will be determined based upon the available margin. The margin is determined based on the benchmark only, mobile to PSTN, or mobile to mobile).

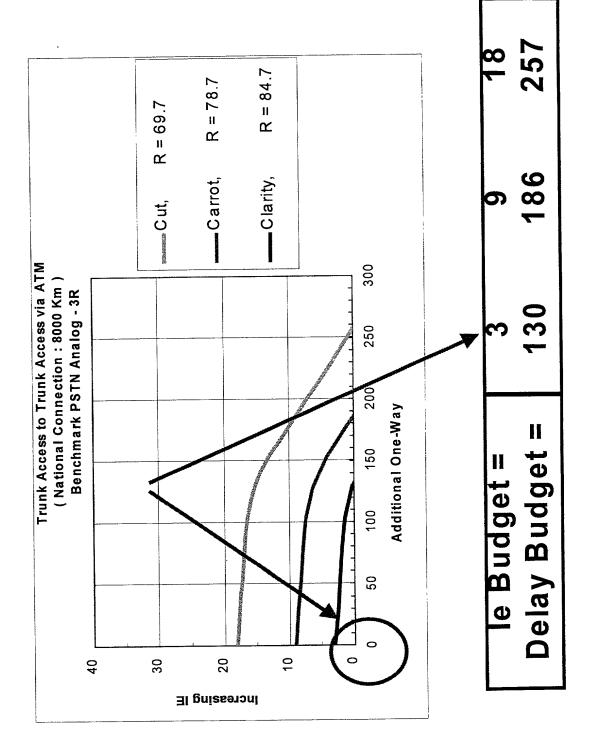


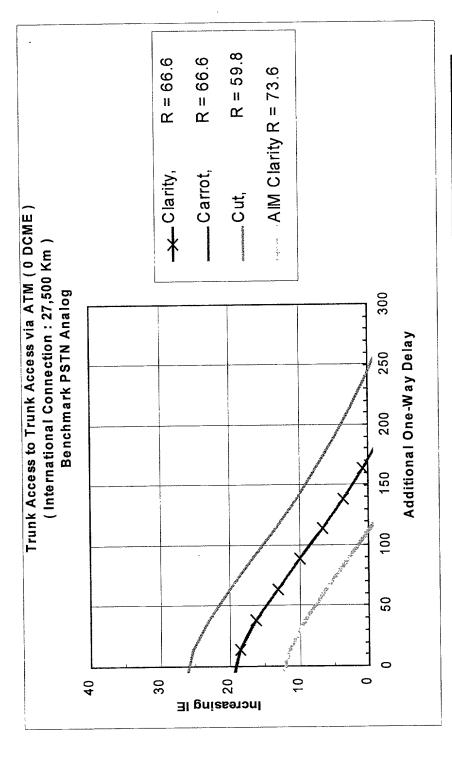
							IP Core Transport	lransp	ort			
		Nationa		International	ional 0	DCME	International	tional 1	DCME	International	tional 2	2 DCME
		ө	¥		9	Y		el	X		e	<del>ረ</del>
POTS TOUNK	145	2	86	264	5	74	293	12	63	321	19	53
	142	5	86	261	ည	74	290	12	64	318	19	53
Wireless	237	9	72	356	10	22	385	17	48	413	24	38
	164	ιΩ	85	283	2	7.1	312	12	61	340	19	51
	158	5	85	277	2	72	306	12	62	334	19	52
National Participation	156	5	85	275	5	72	304	12	62	332	19	52
e e	172	5	84	291	2	70	320	12	09	348	19	20
			_	_								

B-Side Access

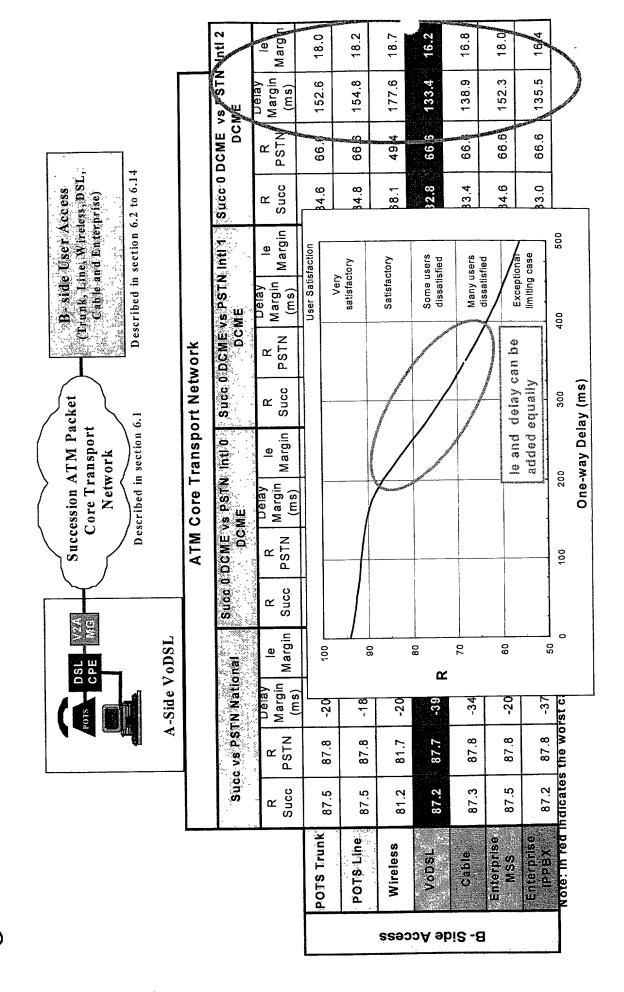
comparison of an end-to-end Succession network with the closest benchmark representation of existing networks (PSTN Note: The four parameters: packetization delay, delay jitter, codec and packet loss have been set to zero. Those four parameters will be determined based upon the available margin. The margin is determined based on the benchmark only, mobile to PSTN, or mobile to mobile).

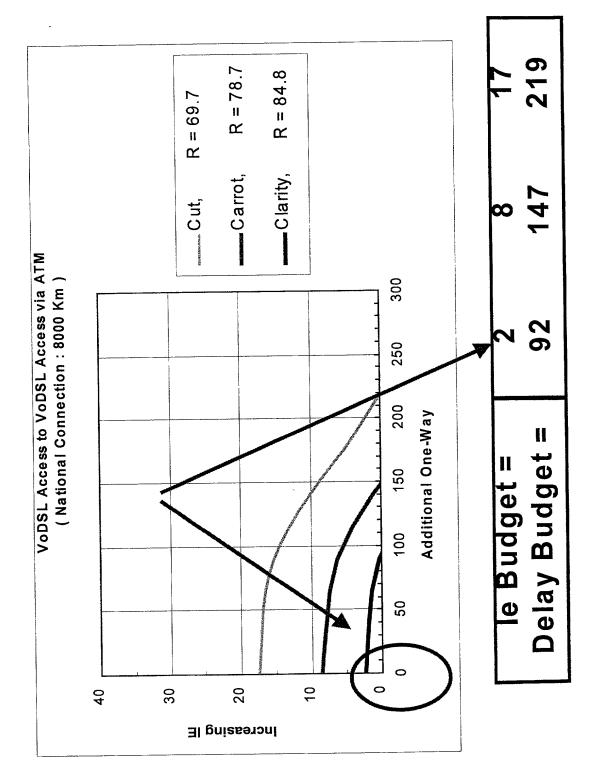


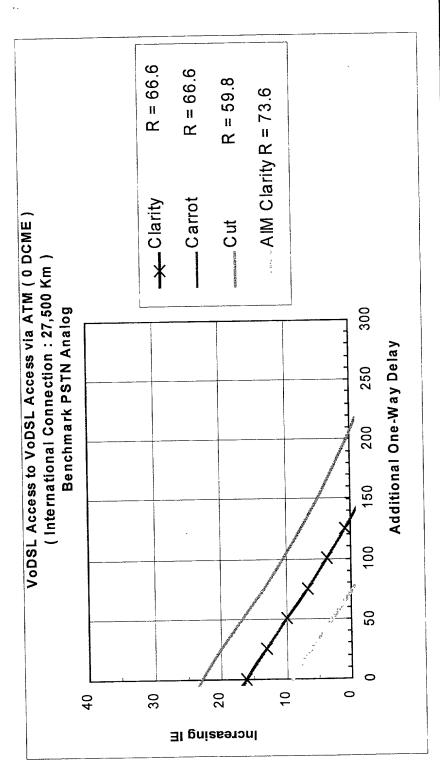




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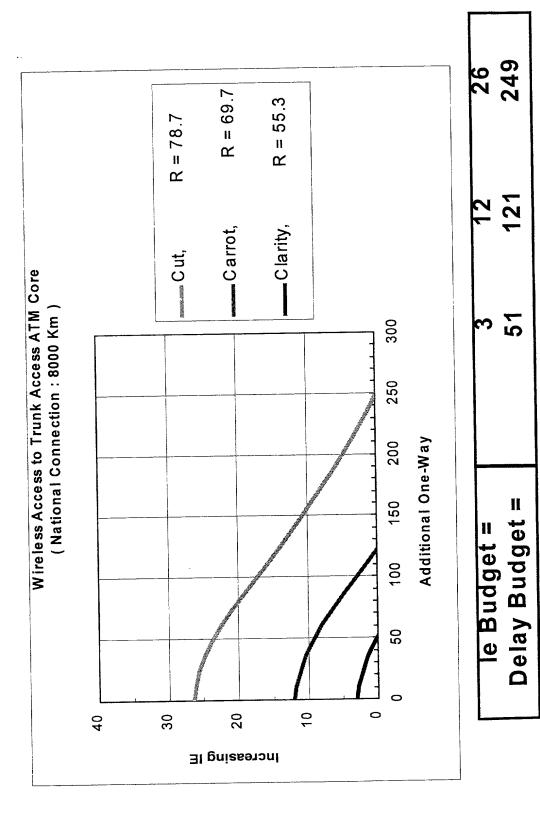


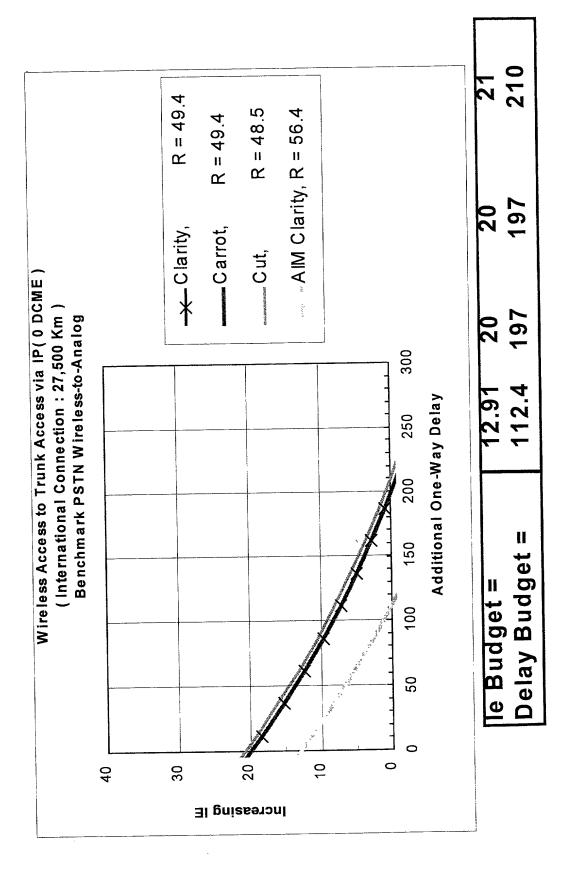


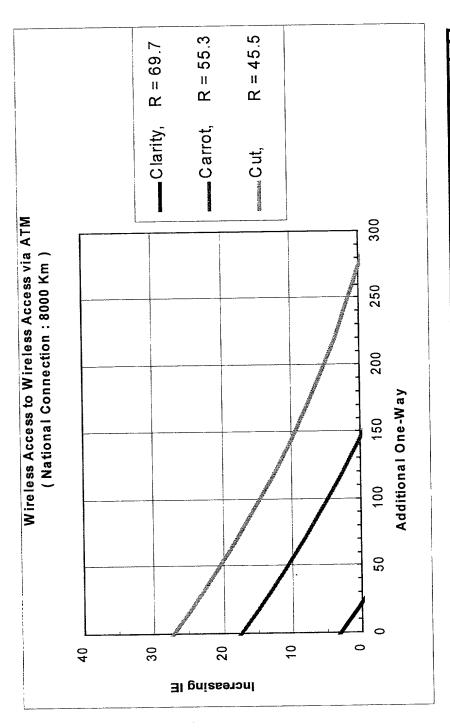


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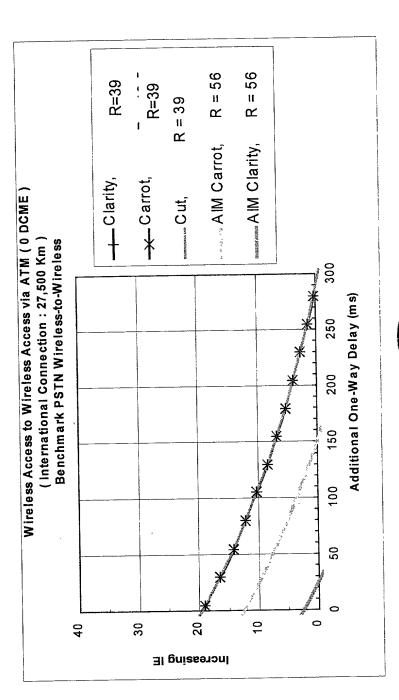
		Inti 2	le Margin	21.3	21.6	19.5	18.7	19.4	21.2	19.0
	:	vs PSTN Inti 2 ME	Delay Margin (ms)	196.8	199.0	192.8	177.6	183.1	196.5	179.7
SS (SSL, (5)			PSTN	49.4	49.4	39.0	49.4	49.4	49.4	49.4
Arches, Interprise		Succ 0 DCME	R Succ	70.7	71.0	58.5	68.1	68.8	9.07	68.4
B. side User Access (Trunk, Line, Wireless, DSL, Cable and Enferprise) Described in section 6.2 to 6.14		S 4.55		10.9	11.2	10.0	8.3	9.0	10.8	8.6
B. (Trum Con	논	SS	Delay Margin (ms)	91.8	94.0	17.8	72.6	78.1	91.5	74.7
To location to the second to t	ATM Core Transport Network	O DGMEVS!	R PSTN	59.8	59.8	48.5	59.8	59.8	59.8	59.8
Succession ATM Packet Core Transport Network Described in section 6.1	sport	gace 0	R Succ	70.7	71.0	58.5	68.1	68.8	9.07	4 70.6 -17.3 -2.2 68.4 59
ccession ATM Pack Core Transport Network Described in section 6.1	re Tran	mtro.	le Margin	0.1	0.4	0.2	-2.5	-1.8	0.0	-2.2
Core	TM Col	IS PSTN	Delay Margin (ms)	-0.2	2.0	8.0	-19.4	-13.9	-0.5	-17.3
	¥	Succ 0 DCME vs.PSTN Inti 0 DCME	R PSTN	70.6	9.07	28.3	70.6	70.6	70.6	70.6
12A MG		Succ 0	R Succ	7.07	71.0	58.5	68.1	68.8	70.6	68.4
C-MSc ireless		ınaı	le Margin	0.1	0.1	0.0	-0.5	-0.3	0.1	5.0-
Brs Bsc - MSc A-Side Wireless		Succivs PSTN National	Detay Margin (ms)	-1.2	1.0	-0.2	-20.4	-14.9	-1.6	-18.4
A-A		c vs PS	R PSTN	81.7	81.7	72.7	81.7	81.7	81.7	81.7
		Suc	R Succ	81.8	81.8	72.7	81.2	81.4	81.8	81.2
				POTS Trunk	POTS Line	Wireless	Vodsi	Cable	Enterprise MSS	<b>Enterprise</b> 81.2 81.7 -18.4 -0.5 68.
				8	Ĭ	>			ш	ш







3.004 17.34 27	21.97 145.8 273
Delay Budget =	77 1



289 248 181 151 Delay Budget = le Budget =

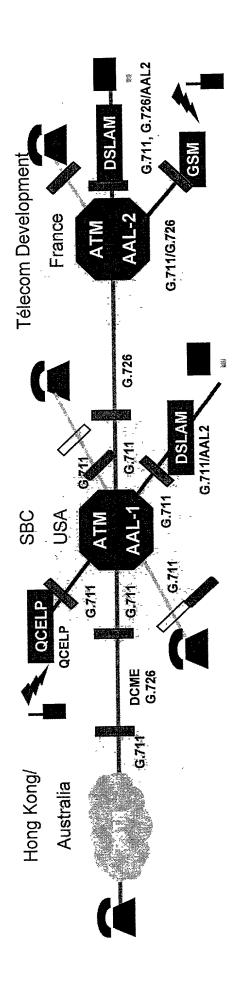
Bank	Codec	E-model	Estimated	Note
Malin		Im pairm ent Factor	im plem entation delay (m s)	
		(Ie)		
	G.711 at 64 kb/s	0	0.125	PCM
2	G.726 at 32 kb/s with Synch Coding	7	0.250	ADPCM
8	GSM-EFR	æ	40	GSM
4	IS-733	*	40	
S.	G.728 at 16 kb/s	7	1.250	
9	G.729/G.729A at 8 kb/s	10/11	25	
7	IS-641	9	40	TDMA
<b>∞</b>	G.723.1 at 6.3 kb/s (not recommended)	15	30	Soft Phone

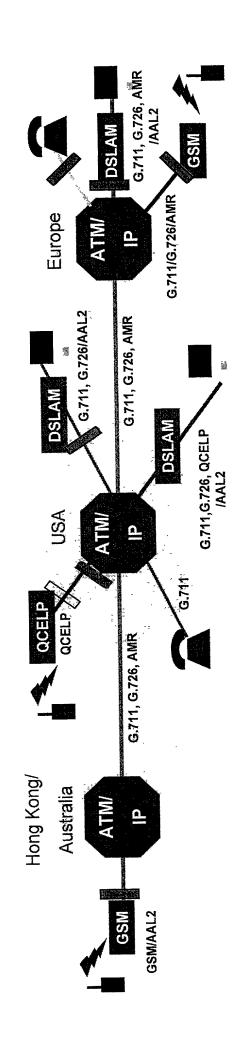
Codec	၁၈	packetization delay (ms)	max packet loss (%)	le due to packet loss
type	Codec le			
		77	/00	
G.711	0	70	80	0
			/00	_
G 711	0	20	% >	>
-			/00	
G 726(1)	7	10	%n	0
\.\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\				

1. This codec is only really suitable for international

le due to packet loss		0	0	0	0	0	0	2	5	
max packet loss (%)		%0	%0	%0	%0	%0	%0	1%	1%	
packetization delay (ms)		10	20	40	10	20	40	10	20	
၁	Codec le	0	0	0		7	7	0	0	
Codec	type	G.711	G.711	G.711	G 726	G.726	G.726	G 711	G.711	

Codec	၁ဓ	packetization delay (ms)	max packet loss (%)	le due to packet loss
type	Codec le			
6.711	0	10	%0	0
G.711	0	20	%0	0
G.711	0	40	%0	0
G.726	/	10	%0	0
G.726	7	20	%0	0
G.726	7	40	%0	0
G.729	-	10	%0	0
G.729	-	20	%0	0
G.729	11	40	%0	0
G.711	0	10	4%	5
G.711	0	20	1%	5
G.711	0	40	1%	ဂင
6.726		10	%_	7
G.726	7	20	1%	4
G.726	7	40	1%	æ
G.729	<u></u>	10	1%	2
G.729	11	20	1%	4





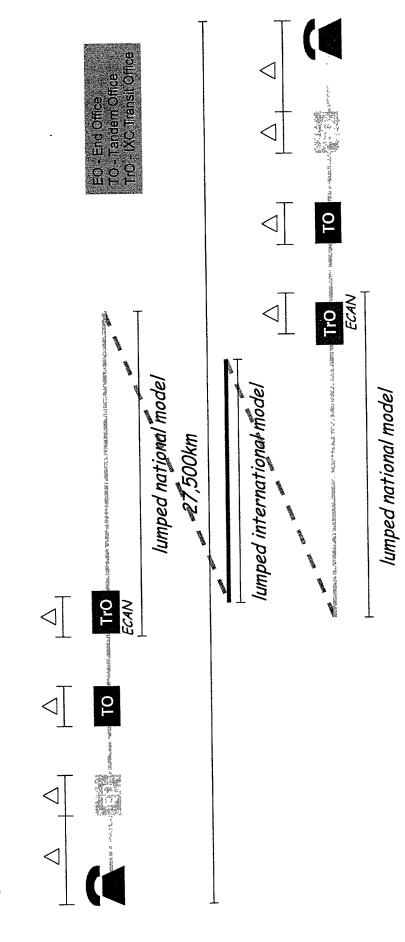
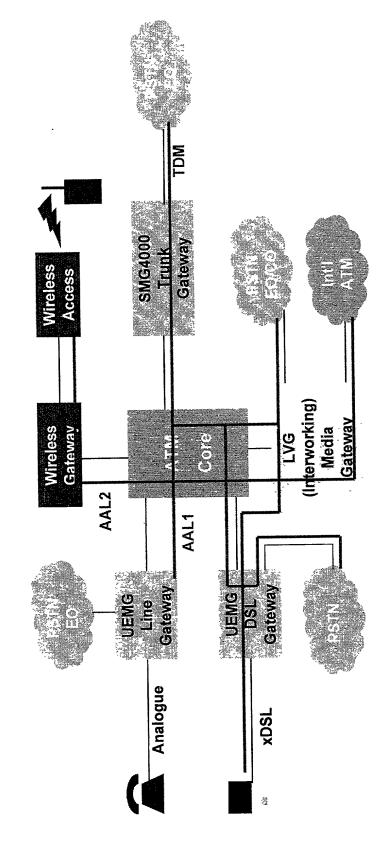
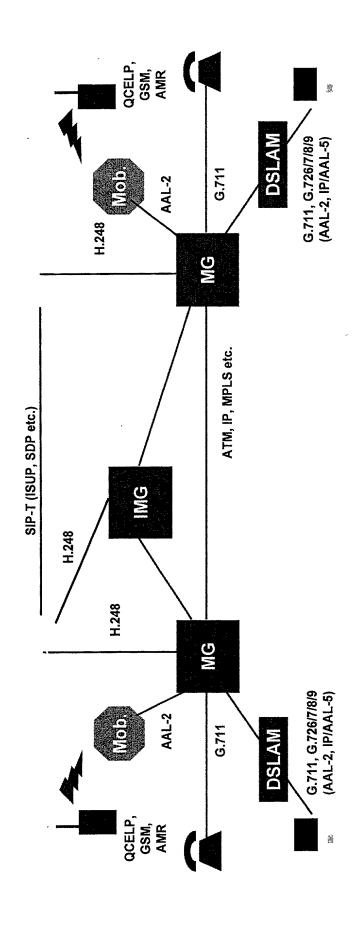


Fig. 71





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the grant, are near salaring outside the first